

March 21, 1944.

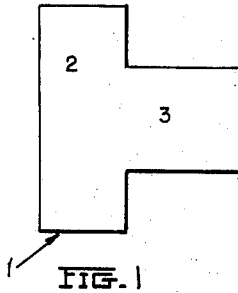
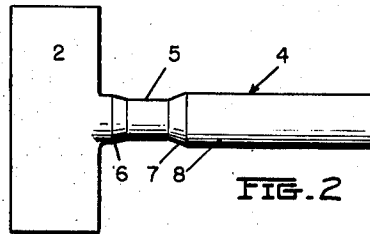
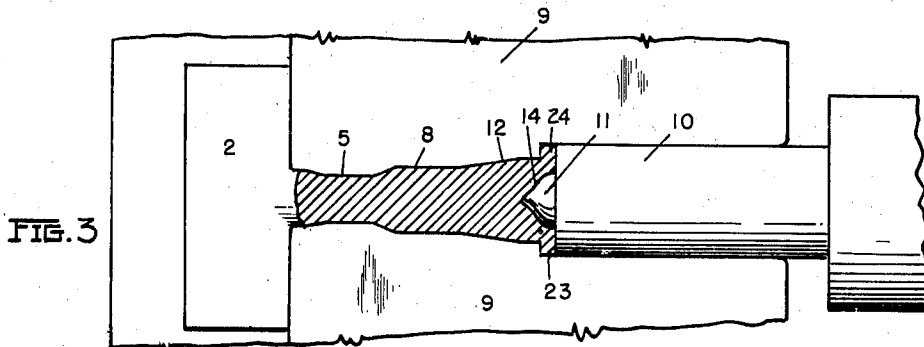
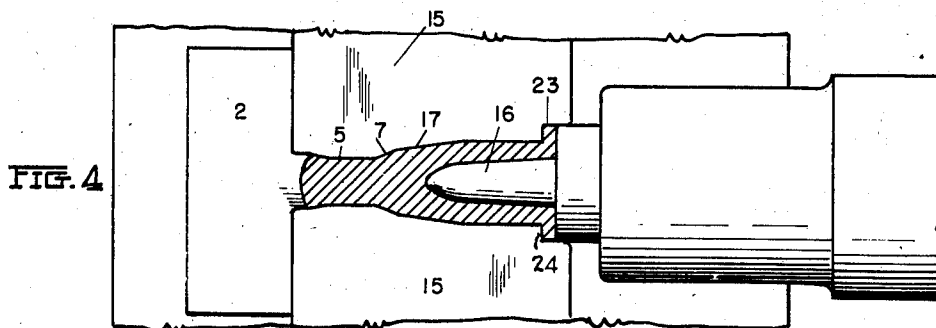
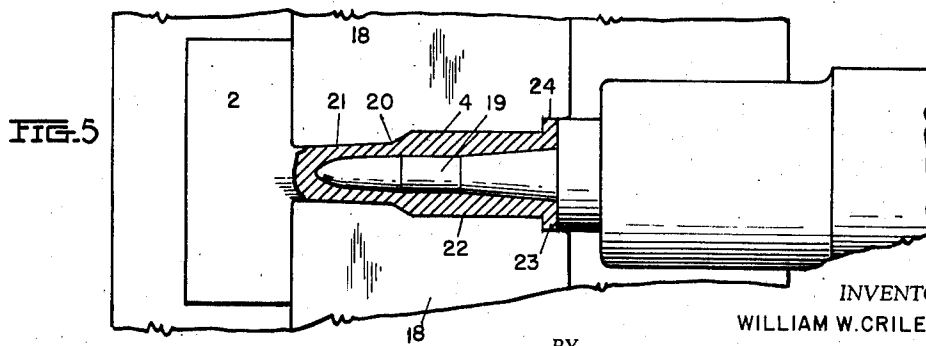
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2,344,803

METHOD OF FORGING SHOVEL SOCKETS AND THE LIKE

Filed Oct. 15, 1940

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

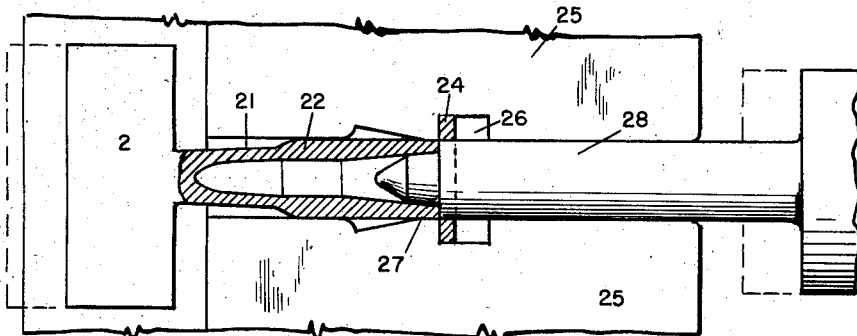


FIG. 6

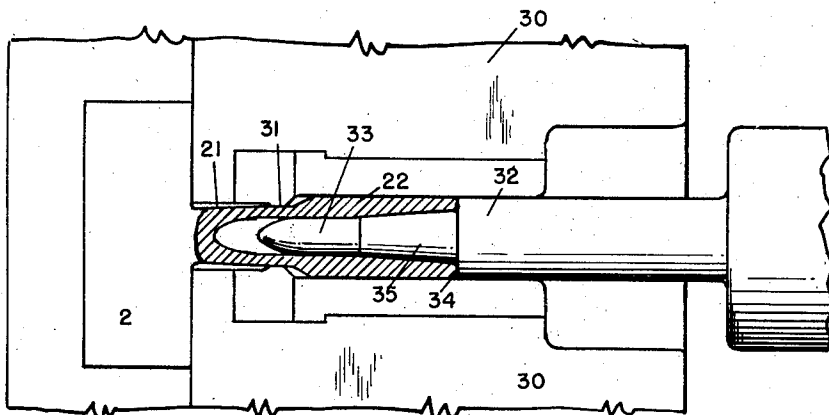


FIG. 7.

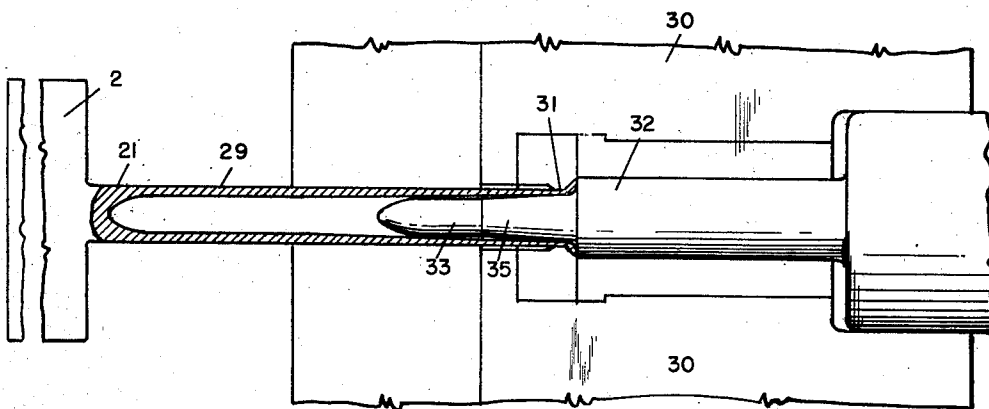


FIG. 8

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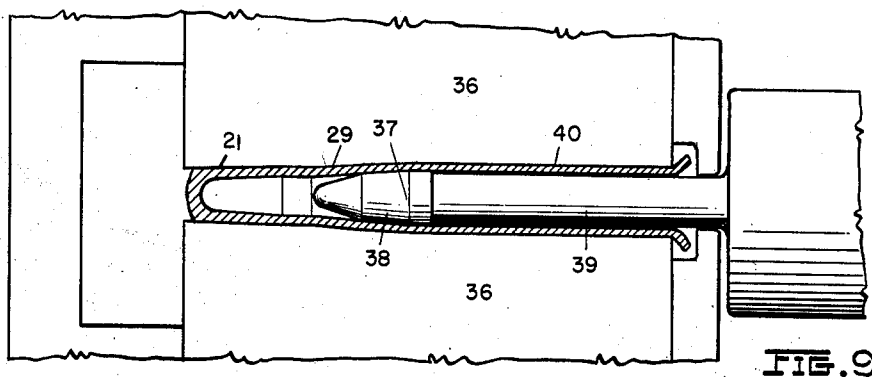
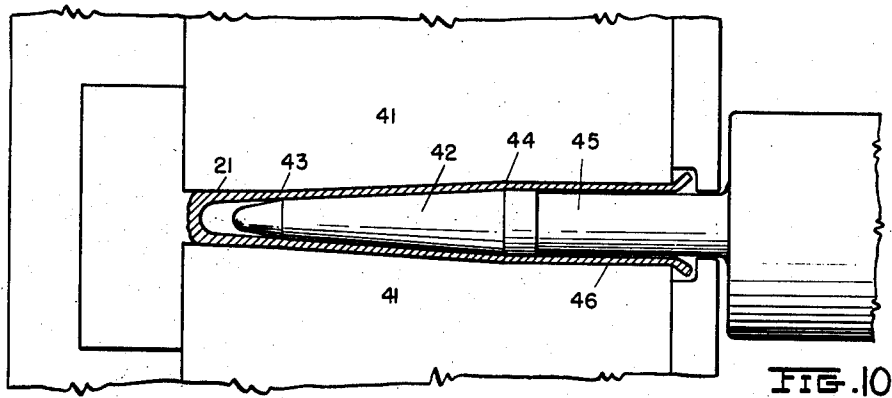
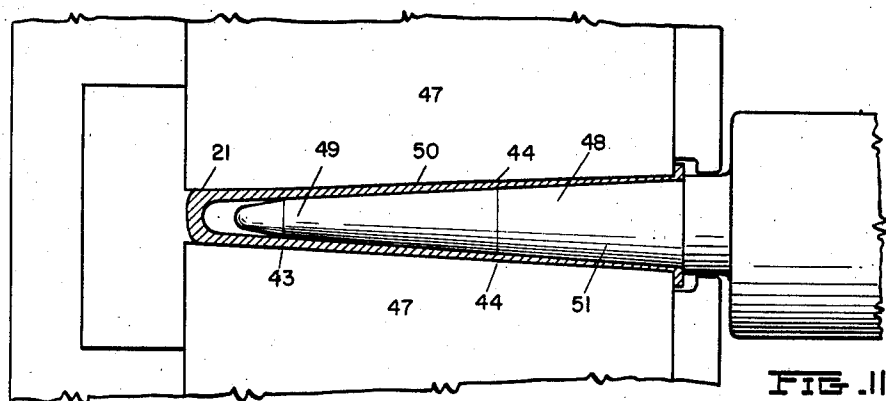
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,344,803

METHOD OF FORGING SHOVEL SOCKETS
AND THE LIKE

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Application October 15, 1940, Serial No. 361,241

8 Claims. (Cl. 207—10)

This invention relates to a method of forging shovel sockets and the like, and more particularly to an improved method of forming such sockets integral with the blank from which the shovel or similar tool is made, by extruding operations per-
formed on metal constituting a part of such blank.

A large variety of tools, such as shovels, hoes, and the like, are adapted to be formed from suitable metal blanks and must be provided with a tang or shank by which they may be secured to a handle. Such tangs or shanks are frequently in the nature of a hollow socket in which the handle for the tool is receivable. In my prior Patent No. 2,054,244, issued September 15, 1936, there is disclosed a method of extruding sockets from cylindrical bar stock, and the invention of this application is an improvement upon and adaptation of the method of my prior patent, enabling the socket to be formed integral with the material from which the shovel or like tool is made.

In the forming of a socket from material integral with the blank from which the tool is shaped it is important that the inner closed terminal of the socket be positioned adjacent the blank in order to reduce the amount of material required and the weight to a minimum. Moreover, it is important that the socket be formed without deforming the blank to which the socket is connected, since such a deformation would require straightening operations after the formation of the socket, which might result in injury to the socket or an undesirable change in the finished shape thereof.

It is a principal object of this invention to provide a method of forming a socket integral with a blank from which a tool is to be shaped in such manner that the blank will not be injured or deformed during the formation of the socket.

A further object is to provide a method of forming such a socket on a blank in which the inner terminal end of the socket is first formed to size and thereafter the outer end of the socket is formed to size.

A further object is to provide a method of forming such a socket in which the socket is formed progressively outwardly from the blank to which the socket is secured.

A further object is to provide a method of forming a socket from a shank integral with the tool blank which involves forming the shank with a reduced neck adjacent the blank in order that the inner end of the socket may be formed to

size without deforming the blank preparatory to finishing the outer end of the socket.

A further object is to provide a method of forming a socket from such a shank which involves piercing the blank to form the inner end of the socket to size and to provide a thick walled hollow section outwardly of the inner end of the socket which may thereafter be finished to size by extruding such section into a thin walled socket.

Other objects of the invention include novel steps for controlling the ultimate length of the finished socket and for expanding and tapering the socket after the same has been formed by suitable extruding operations.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the steps hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail one approved method of carrying out the invention, such disclosed method, however, constituting but one of the various ways in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a plan view illustrating the shape of a blank suitable for use in connection with the method of this invention;

Fig. 2 is a view of the blank of Fig. 1 after a suitable forging operation thereon to form a cylindrical shank;

Figs. 3 to 8 are views respectively illustrating various steps of the method of this invention;

Figs. 9 to 11 are views illustrating the steps in the method of expanding and tapering the socket formed by the steps shown in Figs. 3 to 8.

Referring to the drawings, there is shown a substantially T-shaped blank indicated as a whole by the numeral 1 and comprising the parts 2 and 3 integrally connected together. The part 2 is a blank from which a tool proper, such as a shovel, may be formed by suitable operations thereon. The part 3, projecting from the part 2, is a shank from which a handle-receiving socket may be formed according to the method of this invention. The shank 3 is first forged to provide a solid cylindrical extension, indicated as a whole by the numeral 4, having a reduced neck 5 positioned adjacent the tool blank 2. The reduced neck 5 is defined by an annular shoulder 6 adjacent the blank 2 and an annular shoulder 7 adjacent the portion 8 of the shank 4 positioned outwardly of the reduced neck 5.

After forging the shank 3 to provide the cylindrical extension 4, it will be apparent that the extension 4 will be thicker than the blank 2 at its point of connection to the blank 2. By reason of the differences in thickness of the metal at the point of connection, the shank 4 will be stronger at such point of connection than the blank 2, and the forces applied to the extension 4 during the formation of a socket therefrom, if transmitted directly to the blank 2, are likely to cause a deformation of the blank 2 adjacent the point of connection. It is to prevent such deformation and to permit the formation of the inner end of the socket to size preparatory to finishing the outer end of the socket to size that the necked-down portion 5 is provided. As will be apparent, the necked-down or reduced section 5, providing the annular collars 6 and 7, enable the formation of the socket from the extension 4 without the transmission of substantial forces to the blank 2 which might otherwise tend to deform the blank 2.

In forming the socket the shank extension 4, with the reduced neck portion 5, is positioned between suitable gripper dies 9, 9, and the outer end of the cylindrical portion 8 is upset by an upsetting tool 10 having a projection 11 to provide an enlarged end portion 12 having a cavity 14. The next operation is illustrated in Fig. 4, and in this operation the blank is positioned between a second set of gripper dies 15, 15, and the portion of the shank outwardly of the reduced neck 5 is pierced and enlarged by a piercing tool 16. This last operation provides an enlarged annular shoulder 17 outwardly of the annular shoulder 7 to enable the next operation to be performed without transmitting substantial force to the blank 2. In the steps of Figs. 3 and 4 it will be noted that the reduced section 5 is not changed in shape and that the manner in which such reduced section is held by the gripper dies prevents transmission of force from the tools 10 and 16 to the blank 2.

In the next operation the blank is positioned between gripper dies 18, 18 and the shank 4 is pierced to a point adjacent the blank 2 by a piercing tool 19. In this step the shoulder 17 prevents movement of the section 4 past the point 20 on the dies and holds the section 4 against longitudinal movement while the piercing tool expands and enlarges the reduced neck 5 to the shape as indicated at 21. In this operation the piercing tool 19 also forms the thick wall section 22 outwardly of the section 21. In this step the inner end of the socket, as indicated by the numeral 21, and which extends to the point designated by the numeral 20, is pierced to a point adjacent the blank 2 and is given its final shaping operation, all subsequent operations being performed on the material of the thick walled section 22 positioned outwardly of the point 20.

It will be noted that the dies employed in connection with the steps illustrated in Figs. 3, 4 and 5 are provided with annular recesses 23 adjacent the outer end of the shank being operated on. The tools employed in connection with these dies are shown as being at their innermost operating position. In this manner a space is provided into which excess material contained in the shank 4 may flow to form a collar during the operations described. To have a finished socket of a definite size and length it is necessary that the thick walled section 22 be always formed with the same amount of material. The shank 3 is calculated to provide more than sufficient

material for the formation of the thick walled section 22 and to take care of irregularities during the formation of the shank 3 into the cylindrical extension 4. This excess material is permitted to flow into the recesses 23 and form a collar which is sheared off in the step which will now be described. In the next step the blank, with the thick walled section 22 and connected collar 24, is placed between suitable dies 25, 25 with the collar 24 positioned in an annular recess 26 formed in such dies. The dies 25, 25 are provided with an annular surface 27 which cooperates with a tool 28 having an external surface adapted to fit snugly within the surface 27 of the dies 25, 25. Upon movement of the tool 28 to the left, as shown in Fig. 6, the collar 24 will be sheared from the thick walled section 22 and left in the recess 26. By permitting the formation of the collar 24 in the steps illustrated in Figs. 3, 4 and 5, and shearing such collar off in the manner illustrated in Fig. 6, it will be apparent that the thick walled section 22 will always contain a predetermined amount of metal, enabling the production of a socket of predetermined length.

The step of extruding the thick walled section 22 into a relatively thin walled socket 29, is illustrated in Figs. 7 and 8. In this step the blank is positioned between dies 30, 30 with the thick walled section 22 to the right of a die orifice 31, provided by the dies 30. An extruding tool 32, having a die plunger 33 and an annular shoulder 34, is then moved to the position as shown in Fig. 7, with the annular shoulder 34 in engagement with the outer end of the thick walled section 22 and the end of the die plunger 33 positioned within the orifice 31. The position of the parts prior to the beginning of the extruding operation is illustrated in Fig. 7 and in this position it will be noted that the surface of the orifice 31 moves into engagement with the blank adjacent the outer end of the pierced section 21. As the tool 32 is moved to the left, the thick walled section 22 will be extruded into a thin walled socket 29, as shown in Fig. 8.

In this last operation it will be noted that the metal of the thick walled section 22 is caused to flow toward the blank 2 and in a direction coaxial with the formation of the socket. By piercing the shank to form the inner end 21 of the socket and beginning the extruding adjacent the outer end of the section 21, it will be noted that the socket is first finished adjacent the blank 2 and then formed progressively outwardly to the outer end thereof.

If desired, the die plunger 33 may be provided with a tapered portion 35 in order that the wall thickness of the extruded portion 29 of the socket will be tapered outwardly toward the end thereof.

In the case where it is desired to provide a tapered socket, the steps shown in Figs. 9 to 11 may be employed. In the first step of the tapering operation the blank with the extruded socket 29 is placed between gripper dies 36, 36, and an expanding tool 37 is then forced into the socket 29. The expanding tool 37 is provided with an enlarged tapered end 38 and a reduced neck 39. The tool 37 is forced into the socket 29 to expand the same to a point adjacent the finished inner end 21. By forming the tool 37 with the enlarged end 38, only a small part of the tool is in engagement with the inner surface of the socket, there being a clearance between the expanded portion 40 of the socket and the reduced neck 39. Only that part of the socket being actually expanded is

in engagement with the surface of the end 38. Accordingly, it will be apparent that all parts of the socket are expanded to the desired size by a limited area of the tool 38 substantially instantaneously and progressively inwardly from the outer end thereof in an integrated fashion.

In the next step, the expanded socket 29 is positioned between gripper dies 41, 41 and an expanding tapering tool 42 is forced into the expanded part 40 of the socket. The tool 42 has a tapered end which is adapted to form the socket to the desired tapered size from the outer end 43 of the finished section 21 to the point 44. At the point 44, the tool 42 has its largest diameter which is greater than the inner diameter of the section 40. Rearwardly of this point, the tool 42 has a reduced neck 45 which will be out of engagement with the inner surface of the expanded untapered section 46 of the socket. In this step, the tool 42 operates to further expand the portion 46 to a diameter greater than that of the section 40 in the previous step.

In the final step, the socket is positioned between gripper dies 47, 47 and a final taper is imparted to the portion of the socket outwardly of the point 44 by a tapering tool 48 which is forced into the socket. The part 49 of the tool 48 inwardly of the point 44 is not adapted to perform any substantial tapering action but is employed primarily to prevent deformation of the finished part 50 of the socket due to inward pressure by the part 51 of the tool 48 in tapering the outer end of the socket.

The tapering method of Figures 9 to 11 represents a departure from the conventional expanding or tapering operations in which the expanding is accomplished through the use of one or more tools similar to the tool 48 throughout the tapering operation. In such case, the taper is imparted to the socket gradually along the entire length of the socket and the tool engages with the inner wall of the socket progressively inwardly from the outer end thereof. This results in considerable friction tending to shorten the length of the socket, wrinkle the sidewalls, and damage the mouth of the socket.

In tapering tools heretofore employed for tapering sockets and which have been provided with tapering surfaces engageable with substantially the entire inner surface of the socket, considerable difficulty has been encountered in removing the tool from the socket. It has been found that the tendency of such tools to adhere to the inner surface has been so great that the inner end 21 of the socket is frequently damaged by the removal of the tapering expanding tool from the socket. By the provision of the reduced necks 39 and 45 respectively in the tools 37 and 42, less tool surface is provided for the socket to adhere to and removal of the tool without damage to the inner end of the socket is greatly facilitated. Moreover, by tapering the section 50 of the socket to size prior to tapering the outer end of the socket to size, the possibility of sticking and consequent damage to the socket is materially reduced.

After finishing the socket, a tool such as a shovel, hoe, or the like, may then be fashioned from the wide end portion or blank 2. Although the invention has been described for the case where the socket is formed first, it is to be understood that the same is equally well adaptable to the case where the tool is formed first from the blank 2 and the socket later from the shank 3.

From the foregoing, it will be apparent that the

method of this invention enables the formation of a handle receiving socket from a relatively narrow shank constituting a part of a blank having an enlarged portion from which the tool such as a shovel is to be made, and from which the shank projects. The method enables the formation of the socket notwithstanding the fact that the enlarged portion from which the shank projects extends outwardly in opposite directions from the shank thereby confining the space or area available for working operations.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the method herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In the method of forming a socket of predetermined length on a blank having an enlarged head portion and an integral shank projecting therefrom, the steps of forming a reduced neck portion on said shank adjacent said head portion, gripping said neck portion with said head portion free while disposing said shank in a die cavity having an enlarged recess adjacent the outer end of said shank, piercing and expanding said shank through pressure applied thereto by a die plunger moving toward said blank into said die cavity while permitting the excess material in said shank to flow in a direction opposite to the movement of said plunger and into said recess to form a collar at the outer end of the pierced section, and removing said collar to remove said excess material.

2. In the method of forming a socket of predetermined length on a blank having an integral shank projecting therefrom, the steps of disposing said shank in a die cavity having an enlarged recess adjacent the outer end of said shank, piercing and expanding said shank through pressure applied thereto by a die plunger moving toward said blank into said die cavity while permitting the excess material in said shank to flow in a direction opposite to the movement of said plunger and into said recess to form a collar at the outer end of the pierced section, removing said collar to remove said excess material, and then forming the socket to size by extruding the pierced shank through a die orifice about a die plunger and in the same direction of movement as that of said first named plunger.

3. The method of forming an article which has an enlarged head and a projecting handle-receiving socket integral therewith from a unitary blank comprising a head-forming portion and a relatively narrow shank projecting therefrom, the steps of shaping said shank to define a reduced neck-portion adjacent said head-forming portion, and extruding the metal in said shank positioned outwardly of said reduced neck-portion to form a socket by moving said unitary blank bodily in a direction toward said head-forming portion.

4. The method of forming an article which has an enlarged head and a projecting handle-receiving socket integral therewith from a unitary blank comprising a head-forming portion and a relatively narrow shank projecting therefrom characterized by forming a reduced neck adjacent the junction of the shank and the head-forming portion, disposing said reduced neck in a die orifice and extruding the distal part of the shank portion by causing it to move in a direc-

tion toward said head-forming portion through said orifice and about a die plunger smaller than the same.

5. The method of forming an article which has an enlarged head and a projecting handle-receiving socket integral therewith from a unitary blank comprising a head-forming portion and a relatively narrow shank projecting therefrom, the steps of shaping said shank to define a reduced neck-portion adjacent said head-forming portion, disposing said reduced neck-portion in a die to hold the same, while expanding the portion of said shank positioned outwardly of said reduced neck-portion into a thick-walled hollow section, and then extruding the thick-walled hollow section into a relatively thin-walled socket by flowing the metal therein in a direction toward said head-forming portion.

6. The method of forming an article which has an enlarged head and a projecting handle-receiving socket integral therewith from a unitary blank comprising a head-forming portion and a relatively narrow shank projecting therefrom, the steps of shaping said shank to define a reduced neck-portion adjacent said head-forming portion, disposing said reduced neck-portion in a die to hold the same, while expanding the portion of said shank positioned outwardly of said reduced neck-portion into a thick-walled hollow section, piercing and expanding said reduced neck-portion to form the inner end of the socket, and then extruding the thick-walled hollow section into a relatively thin-walled socket by flowing the metal therein in a direction toward said head-forming portion.

7. The method of forming an article which

has an enlarged head and a projecting handle-receiving socket integral therewith from a unitary blank comprising a head-forming portion and a relatively narrow shank projecting therefrom characterized by forming a reduced neck adjacent the junction of the shank and the head-forming portion, piercing and expanding said reduced neck-portion to form the inner end of the socket, disposing said neck-portion in a die orifice and then extruding said thick-walled section into a relatively thin-walled section by causing it to move in a direction toward said head portion through said orifice and about a die plunger smaller than the same.

8. A method of forming a shovel or like tool having a wide head portion and a relatively narrow receiving socket extending integrally therefrom which comprises providing a unitary blank having an enlarged portion from which projects a relatively narrow shank, forming said shank to define a reduced neck portion adjacent the enlarged portion aforesaid, disposing said reduced neck portion in a die to hold the same while piercing and expanding the portion of said shank positioned outwardly of the neck-portion into a thick-walled hollow section, disposing said expanded part in a die to hold the same while piercing and expanding said reduced neck-portion to form the inner end of said socket, disposing said neck-portion in a die orifice and then extruding said thick-walled section into a relatively thin-walled section by causing it to move in a direction toward said head portion through said orifice and about a die plunger smaller than the same.

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